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### Identification and Significance of Innovation

A reliable, efficient, compact propellant mixing pump for cryogenic fluid management applications

- Prevent thermal stratification to control propellant storage pressure

Innovative operating mechanism to enable reliable operation at cryogenic temperatures

Eliminate mechanical pistons or impellers

- No mechanical wear and vibration

No pump cavitation problem; self-priming

High pumping performance

Estimated TRL at beginning and end of contract: ( Begin: 3 End: 4 )

### Technical Objectives and Work Plan

#### PHASE I RESULTS

Successfully demonstrated operation with two-phase refrigerant

- Pressure rise: > 1 psi
- Volumetric efficiency: ~ 50%

Prototype cryogenic pump design

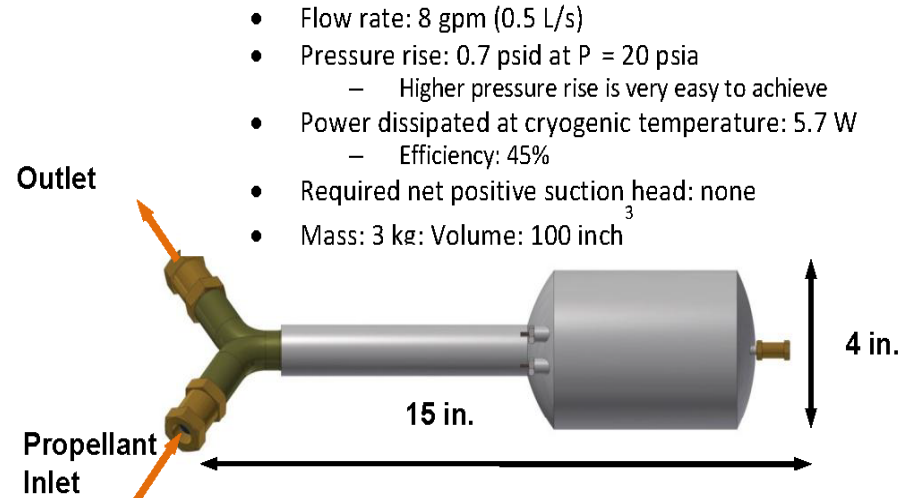
#### PHASE II TECHNICAL OBJECTIVES

Reliable, efficient operation with two-phase cryogen

High pumping performance  
Lightweight and compact  
High fidelity pump analysis model

#### PHASE II WORK PLAN

Develop key components  
Fabricate and test a pump with refrigerant at room temperature  
Design and assemble a cryogenic pump



### NASA Applications

Zero Boil-Off storage of cryogenics

Short-term vented cryogen storage

Low-G reliable compression mass gauge

### Non-NASA Applications

General cryogenic fluid management and transfer

Two-phase thermal management systems for military and commercial high power electronics systems

### Firm Contacts

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